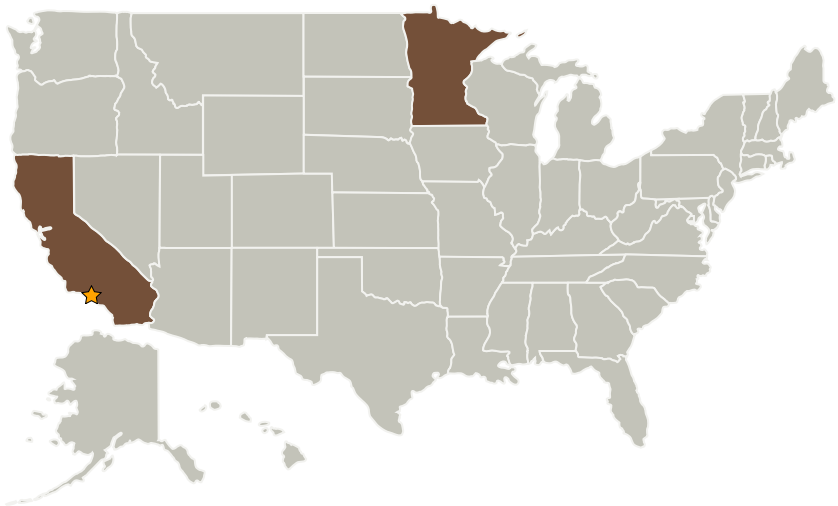
Integrated Production of Ultra-Low Defect GaN Films and Devices for High-Power Amplifiers, Phase II

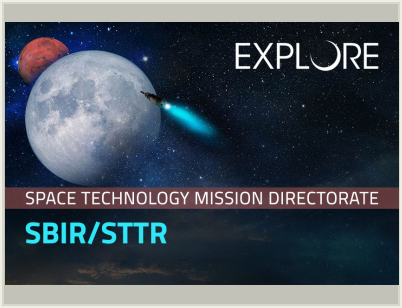
Completed Technology Project (2009 - 2011)

Project Introduction

High quality GaN epitaxial films are one of the keys to current efforts for development of both high-power/high-speed electronic devices and optoelectronic devices. In fact, solid state lighting, high-temperature and high-power electronics, microelectronic and mechanical sensors, and high-efficiency solar cells are all poised at a new level of development. This enormous market is waiting for low-cost, high quality substrates to achieve performance and fabrication economies of scale. After achieving dislocation densities below 1E7 cm-2 in the phase I work, this NASA SBIR phase II project addresses the development of a dislocation filter that can routinely prepare low-stress GaN thin films with threading dislocation densities below 1E6 cm-2. The method relies on using a low-angle ion beam to induce both nanofilter for defect reductions and to inhibit droplet formation at low growth temperatures. Dislocation densities have so far been determined by standard etch pit densities method. The goal the project to optimize the multiple defect nanofilter with smoothening by transition layers in between filters to reduce the TD to less than 1E6 cm-2 and process, fabricate high performance HEMT for solid state high power amplifier (SSPA) applications. To obtain a more practical evaluation of the effectiveness and commercial viability of the method, heterojunction field effect transistors with high electron mobility will be fabricated in these ultra-low defect density films. These high-quality material based high electron mobility transistors (HEMTs) will enable high linearity power amplifiers with excellent thermal stability and frequency response. The proposed method to grow on low-stress, low-dislocation density films will lead to the production of electronic devices of unparalleled performance.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
SVT Associates	Supporting Organization	Industry	Eden Prairie, Minnesota

Primary U.S. Work Locations	
California	Minnesota

Project Transitions

March 2009: Project Start

July 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes